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ABSTRACT

In this report, two feasibility studies for international airports in the Far East, at Jakarta, Indonesia, and at Hong Kong, are described. For each situation, questions concerning the utilization and development of available facilities, future needs, and sources of finance were among questions investigated. This paper describes steps involved in the determination of this information, as well as the actual recommendations made in the studies. (CP)

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FEASIBILITY STUDIES FOR INTERNATIONAL AIRPORT DEVELOPMENT IN THE FAR EAST

By

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Systems Engineering Division
The Ralph M. Parsons Company

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This paper will discuss two feasibility studies for international airports in the Far East prepared by The Ralph M. Parsons Company. From these cases, one will observe the uses of economic analysis and some of the problems of applying it under field conditions. The two studies were conducted for proposed new international airports at Jakarta, the capital of Indonesia, and at Hong Kong, which is under British rule.

The Ralph M. Parsons Company is a world-wide engineering firm engaged in planning, design, and construction of petrochemical plants, metallurgical plants, power plants, aerospace facilities, solid waste disposal systems, subways, shipyards, ports, municipal water systems, industrial plants, and air transportation facilities. Since 1968 the Company has been managing the expansion of the Honolulu International Airport, and has done airport planning, design or construction management at Albuquerque, Baltimore, Dallas-Fort Worth, Hong Kong, Jakarta, Newark, Panama, Taipei, and for the States of Illinois and Ohio.

The Jakarta International Airport study contract was with the U. S.

Agency for International Development. The field work was done in 1970 and the final report was submitted in August 1971. The Hong Kong Civil Aviation Department, after international competition, engaged the Company in April 1973 and the final report was submitted in January of 1975.

In each case, the clients wanted answers to the following questions:

1. What would the unconstrained demand for airport facilities be for 20 years in the future?

2. What were the capabilities of the existing facilities?

3. What were the possibilities for exparding these facilities?

4. What were possible sites for a new airport and which was the best site?

5. What would be the cost of expanding the existing facilities or of a new airport?

6. What were the possibilities of financing a new airport?

7. What were the non-revenue benefits and costs of alternative courses of action in absolute terms and expressed as present value?

8. How could uncertainties about the future be best accommodated in the planning process?

To answer these questions, in each case the Company assembled a team with

a variety of skills - from the engineering side a civil engineer, a soils engineer, an airport planner, an air space and navigation expert, a ground transportation planner, and a cost estimator; and from the economic side, a general economist, an air transportation economist, and a financial analyst. Since the entire range of required skills was not available on our staff, we teamed with other companies as subcontractors to fill the necessary gaps - with Northrop Corporation at Jakarta and with Arthur D. Little and Wilbur Smith at Hong Kong. Parsons retained responsibility for the quality and timeliness of all the work.

I was chief economist in the field and supervised preparation of the air traffic forecasts, financial analysis and economic analysis for both Jakarta and Hong Kong. In the case of Jakarta I became project manager in the home office responsible for the preparation of the final report.

In each case our work was subject to periodic review by a high level governmental body. For Jakarta, review was performed by the Indonesian National Planning Board, Bappenas, by the Indonesian Director General of Aviation, by the resident staff of the World Bank in Jakarta, and by A.I.D. At Hong Kong, an Intergovernmental Steering Group with representatives from the Departments of Public Works, City Planning, Finance, Economics, and Environment joined the top staff of the Civil Aviation Department to review each technical report and discuss them with our team at five separate three-day meetings during the investigation.

In each case a new airport would represent a very major capital expendi-

ture in the context of the local economy. For Jakarta it would require about $200 million in an economy with a per capita income of about $100 a year. The acute capital shortage in Indonesia required use of a discount rate for planning purposes of 20 percent. For Hong Kong, because of the difficulties of the terrain, a construction cost of about US $1 billion is expected in a community with a population of under five million.

The economic aspects of these feasibility studies -- air traffic forecasts, economic benefit analysis, financial analysis, and summary benefit/cost analysis -- took almost one-half of the manpower and budget. In a front-end feasibility study I believe this is appropriate.

The demand analysis -- the air traffic forecast -- is the forcing part of the investigation. The volume of passenger traffic with appropriate relationships to the mix of aircraft, load factors, and peaking characteristics determines the requirements for runways and taxiways, for terminal building space, for curb access and for highway access to the airport. The air traffic forecast is fundamental in a projection of airport revenues and operating costs, and of net operating income available to cover capital charges such as interest and loan amortization. The forecast is also essential to estimates of future benefits from savings of time for business travelers, or from the contribution of tourist expenditures to the local economy.

Since the time required for developing a major new airport, from planning,

through land acquisition, site preparation, design and construction in a developing country or under difficult topographical circumstances may be from six to ten years, and since it must be expected to operate for a generation or more, a forecast period of at least 20 years was essential. For engineering planning and cost estimates a specific forecast value in each year, or at five year intervals at a minimum, was necessary. For this purpose we used our most probable forecast.

The future is sufficiently uncertain, however, that a rule of prudence required that we consider a range of possibilities with the most probable forecast being in the middle of the range. At Jakarta we established a high and low limit of the range with the judgment that there was not more than a 10 percent chance that future results would be above the high end or below the low end. The high end can be read as a higher result in 1990 than the probable forecast, or that the 1990 forecast result will actually occur several years earlier, and the reverse at the low end.

The high end of the range is useful in planning the ultimate size and land area of an airport. The high end also serves as a warning of the earliest time at which congestion may occur at existing facilities. The low end of the range provides a test of how long it may take net revenues from the airport to repay loans or advances for construction costs. The low end also sets some minimum limits on the future benefits to the economy.

The justification for construction of a new international airport is gen-

erally some combination of the following:

- Inability of present facilities to handle the prospective air traffic.
- Physical limitations on [illegible] very high costs for adequate expansion of existing facilities.
- The safety hazards and increasingly objectionable noise levels as air traffic increases over dense urban development which has grown up around the existing airport.
- The opportunity cost for continuing use of this valuable urban land for an airport.
- The ability of net revenues from airport operations, landing fees, passenger exit fees, rentals, concessions, and other sources, less operating expenditures, to cover capital costs for a new airport in a reasonable time.
- The potential loss to the local or national economy if air traffic is restricted by inadequate facilities considerably below the level of free-market demand.

The Jakarta International Airport at Kemayoran is the hub of the domestic air transportation system of Indonesia. In 1970 it also handled 95 percent of air passengers between Indonesia and the rest of the world.

Indonesia is a vast archipelago of over three thousand islands between

continental Southeast Asia and the Australian continent. The total area stretches 3000 miles from east to west and 1100 miles from north to south. Indonesia is the fifth most populous country in the world, with a 1970 population of approximately 120 million. It is growing at the rate of about 2.5 percent a year, so that by 1990, the population is expected to be around 196 million. Approximately 70 million people live on the island of Java, the smallest of the five principal islands. The population of Indonesia is largely rural; not over 20 percent is considered urban.

Jakarta, on the north coast of west Java, has increased from approximately 500,000 when Indonesia declared its independence from The Netherlands in 1945 (the city was then called Batavia), to a city of over five million today. In the next 20 years it can be expected to at least double. Jakarta accounted for 4.5 percent of the national population in 1970.

Air transportation is essential as a rapid link between the capitol and the various cities and islands, and among the islands throughout the archipelago.

The first 25 years of independence for Indonesia offered a very insecure base for forecasting air traffic. The years from 1945 to 1965 were a period of great internal and external stress. After the Declaration of Independence in 1945, four years were required to obtain full recognition from the Netherlands. The conflict over ultimate boundaries dragged on until 1962, and conflict with Malaysia absorbed further energies, includ-

ing some armed conflict, through 1965.

At the same time the economy of Indonesia was undergoing a change as the nation asserted its freedom from external control and tried a variety of mixes of public and private enterprise. In 1957, Dutch firms dominant in international trade, commercial banking, manufacturing and plantations were taken over and operated as public enterprises. Later British and American companies were taken over. The government asserted that it was adapting socialism to Indonesia's conditions. Private foreign investors were not welcomed. Poor economic management led to inflation rates of over 100 percent per year, and a declining standard of living. In the spring of 1965 Indonesia withdrew from the United Nations and associated agencies.

The forces of inflation and economic disintegration were far advanced by 1965. The political end of these decades of trial came with a coup attempt on September 30, 1965 when Indonesian communists assassinated six leading army generals. A counter revolution led by General Suharto completely eliminated communist influence, and the New Order government of which General Suharto is President has restored a private enterprise approach to investment.

A complete shift has occurred in governmental policy and economic climate. The Suharto Government has promoted economic stabilization, encouraged foreign private investment, rejoined the United Nations and other international organizations, and welcomed foreign governmental aid on a

bilateral and a multilateral basis.

The results of the first four years of the Suharto Government and of the first year of the five year (1969-1974) development plan, were observable. By the latter part of 1970, price increases had been cut to 10 percent a year. A stable exchange rate with the dollar had been maintained. Gross domestic product in real terms was up 6.6 percent in 1968 over 1967, the best gain in a decade. Most of the production objectives of the first year of the five year plan had been met. Prospects for the period 1970 to 1975, the first planning date for this study, indicated a sharp rise in expenditures on capital projects.

The success of the Suharto Government was the basis for our assumption that growth in real Gross Domestic Product would continue at their projected rate of 5 percent a year.

In the development of a demand forecast all of this and more had to be learned and taken into account. The actual records of passenger movements and aircraft active at Kemayoran went back to 1962, except that there were no records maintained in 1966 which was during and immediately following the civil war. International passenger movements declined from 1962 to 1964, and in 1965 there were almost no in-transit passengers. After the new government was established air traffic increased rapidly. Each year's percentage growth exceeded the previous year's, culminating in a 58 percent annual growth in 1970, the year of our study. Domestic passenger movements were also increasing at an increasing rate, with a

40 percent annual increase in 1970.

Against this background it was impossible to utilize a standard statistical method of forecasting. Normally one would project past trends on the assumption that the underlying factors creating these trends would continue with the same relative force in the future; or one would correlate past passenger traffic with such independent variables as regional income and population growth, find reliable forecasts of the independent variables and develop the air passenger forecasts from the appropriate correlation coefficients. Since neither past data nor future projections were of a quality to warrant such an approach we had to make a judgment forecast.

To make a judgment forecast for passenger traffic we took account of the following factors:

- The actual expansion at Kemayoran from 1967 to 1970.
- The average rate of growth in international passenger movements at Kemayoran from 1962 to 1970.
- The commitment of foreign capital and foreign governments to investment expenditure in Indonesia over the next five years.
- The planned rapid expansion of hotel accommodations in Jakarta over the next five years.
- The past history of Pacific Area tourist travel, projections of

Pacific Area travel and of the prospects for Indonesia to enlarge its share of regional tourism.

- The experience of the Southeast Asian and Pacific countries in air transportation from 1962 to 1968 which showed a reasonable correlation between growth in real Gross Domestic Product and international passenger movements. For example, when GDP was growing at five percent a year, passenger movements increased 15 percent a year.

- The Indonesian Government forecast of five percent a year growth in GDP, which was credible on the basis of performance between 1967 and 1970.

- The record of all international air passenger growth for 1963-1968; in the Far East the annual average was 20 percent and throughout the world, 12 percent.

From this evidence we prepared a forecast in the simplest possible terms.

1. From 1970 to 1975 we forecast a growth in absolute numbers each year equal to the 1970 absolute growth. This was the highest increase in history, but by using a constant number the percentage growth steadily declined.

2. From 1975 to 1980 we forecast a 15 percent a year growth rate, corresponding to the recent experience of other nations in the region with an average five percent growth in GDP.

3. From 1980 to 1990 we forecast an 11 percent a year growth rate, one percent below the world average. By 1980 the volume of passenger traffic at Jakarta would have risen to almost five million a year, and at the higher base a slower growth rate was appropriate.

The forecast, when converted to aircraft operations, would require an airport with two independent parallel runways by the mid 1980's. This established the ultimate size of the required airport. For 1980 a single runway able to handle all sizes of aircraft and with no air navigation obstructions would be adequate, and this would determine the initial investment.

The experience subsequent to our report has been interesting. The international passenger movements have grown but somewhat more slowly than our forecast. The domestic passenger movement growth has exceeded our forecast. The growth in real Gross Domestic Product has been above five percent per year, and in developing countries air travel responds rapidly to economic growth. Total passenger traffic has equalled our probable forecast. Since domestic traffic was in smaller aircraft, 44-seat and 109 seat-aircraft versus 140 seat-and 350 seat-aircraft in international traffic, the increase in actual aircraft operations was in the high range of our forecast -- in 1973 they experienced the forecast 1975 rate.

I would like now to turn to the Hong Kong study, which was completed in January of this year but for which the demand forecast was completed in October 1973 on the basis of experience through 1972.

The development of Hong Kong is one of the great success stories of the post World War II era. Situated at the mouth of the Pearl River, the area between the Island of Hong Kong and mainland is one of the great natural harbors of the world. Following the success of the Chinese Communist revolution in 1949, many thousands of Chinese fled to Hong Kong - wealthy merchants and manufacturers from Shanghai, professional people and working people from nearby Kwantung province. The population rose from one and three-quarter million in 1947 to over three million in 1960: it is now over four million and will exceed six million by 1995. The thousands of refugees provided a willing work force, thankful for any chance to earn a living. Steady application of skill, and sharp attention to style has raised the quality of output from low wage bargain basement materials to high-style clothing commanding high prices as it is flown by air cargo direct to many cities in the United States.

The central location between Japan and Korea in the north and Singapore and Bangkok in the south made Hong Kong a natural shipping center. The current volume of its trade - the total value of its imports, transshipments and exports - equals the total value of the trade of India. The growth in real income per capita over the past decade has been about five percent a year, a rate exceeded only in Japan.

Hong Kong's central location has made it an air transportation hub in

the Far East. It is also the favorite destination of tourists among all Far Eastern and Pacific cities. The result over the past 22 years has been a fairly steady growth rate in air passenger traffic averaging nineteen percent a year.

To forecast the future passenger traffic, we examined the actual record of visitor arrivals by air and sea from 19 countries that each sent 5,000 or more visitors to Hong Kong in 1972. In 1972, 96 percent of all visitors arrived by air. These 19 countries accounted for over 90 percent of all visitors. For the previous decade a correlation was established for each country between visitors to Hong Kong as the dependent variable, and total population and real GNP per capita as independent variables. From United Nations studies we secured forecasts to 1985 of the population and real GNP per capita of each of the 19 countries. A preliminary forecast of passengers to Hong Kong for 1975, 1980 and 1985 from each country was derived from the appropriate correlation. The formula was:

$$V = aG^c$$

where:

V = the visitors per million population

G = GDP per capita in constant terms and local currency

c = constant coefficient (elasticity of V with respect to G), and

a = a constant, the intercept

The forecasts derived from this formula were then examined for reasonableness. In some cases, the growth appeared too high. From Japan,

for example, 25 percent of all tourists each year have visited Hong Kong. Japan is forecast to have a high rate of growth of tourists to foreign countries, and the percentage visiting Hong Kong is expected to decline, even though the numbers will increase. The combined total of the adjusted forecasts for the 19 countries were then increased 11 percent to allow for traffic from all other countries. Traffic of Hong Kong residents was forecast in the same fashion. The combined totals then provided aggregate forecasts for 1975, 1980, and 1985. We did not believe we could forecast with this degree of detail beyond 1985, so for the next two five-year periods, we used 80 percent of the growth rate for the preceding five year period.

In comparison with the 19 percent historical growth rate, the forecast called for these annual growth rates:

1972 to 1975 - 18.2 percent
1975 - 1980 - 14.4 percent
1980 - 1985 - 10.9 percent
1985 - 1990 - 8.9 percent, and
1990 - 1995 - 6.8 percent.

Around this "most probable" forecast, a range was established. The high end assumed that the growth rate would be 20 percent faster and the low end that the growth rate would be 20 percent slower than the most probable forecast.

Subsequent experience was a growth in calendar 1973 of 23 percent, and in calendar 1974 a growth of only 5 percent as a result of the worldwide

recession. Both results were within the upper and lower limit which we established as a range. The biggest apparent error has been in an underestimate of air traffic by Hong Kong residents which has already exceeded the 1975 forecast. This is another example of the tendency for air travel to command an increasing share of total expenditures as per capita incomes rise in developing countries.

After the forecast was completed, it was compared with other forecasts already made for other international airports in the Far East - Singapore, Bangkok, Taipei, Manila, Seoul, and Jakarta. The latter was the only other one prepared by The Ralph M. Parsons Company. The similarity of the forecasts was rather striking. On a semi-log chart, the Singapore forecast fit under the Hong Kong forecast like a hand in a glove. (See attached Figure) The Jakarta forecast had an approximate pattern and direction similar to the others.

Closely related to the forecast of air traffic is the forecast of benefits to the economy.

Air transportation is vital for Indonesia since the alternative is time consuming surface transportation. In contrast to the one and one-half hour flight from Singapore to Jakarta, it would be a two-day sea voyage. Domestic flights within Indonesia save an average of a full eight-hour working day over rail or sea. In connections with distant islands, air travel saves several working days over sea.

Business air travelers are highly productive business and professional

men, technicians, and government officials. Saving of their time by air travel enables them to devote more time to direct production effort, or to apply their efforts in more places in the Indonesian archipelago. Seventy percent of international air travelers arriving at Jakarta in 1970 were traveling for business purposes. Surveys in 1969 indicated the average value of a foreign businessman's time to be $5 per working hour, and we estimated the time of an Indonesian traveling for business to be $2 per working hour. The aggregate value of the time saved by international air travel, and which can be applied to productive effort in Indonesia or which reduces the cost of projects in Indonesia, amounted to $11 million in 1970. Domestic air travel for business saved $3 million. Tourist travel is also stimulated by availability of air travel facilities. Each tourist was estimated to spend $125 on goods or services supplied by Indonesia. The total value of business time saved and of tourist travel stimulated by the Kemayoran Airport in 1970 was estimated to be $15 million.

The future is expected to see a more rapid increase in foreign tourist growth than in foreign business growth as Indonesia slowly increases its share of Pacific tourist travel. Domestic business travel would grow rapidly with the economy. Using a constant 1970 price level - the total value of air transportation in the year 1990 was estimated to be $227 million. When converted to present value at January 1, 1972, a hypothetical decision point, using the 20 percent discount rate which was standard for all capital planning in Indonesia because of the acute shortage of capital in place, the present value was $7 million.

The aggregate of present value for all the years 1972 to 1990 was $288 million.

The benefit analysis was carried one step further to estimate the incremental benefit from a new airport over what would be secured from the existing airport with needed expansion. This was $75 million in 1970 prices. These values became significant in the final decision process.

In Hong Kong, we estimated the contribution of air transportation to the receipt of foreign exchange, to employment, and to the GDP. Spending by foreign visitors (96 percent traveling by air) amounted to more than 9 percent of the value of Hong Kong's total export of goods and services and represented more than 75 percent of the total value of "exported" services, such as banking and insurance. Total exports of all goods and services in Hong Kong was almost equal to GDP. Between 1966 and 1972, tourist expenditures were growing at an average rate of 20 percent a year, while GDP was growing at a rate of 13 percent (in current dollars).

The direct contribution of the air transport system in value added to the GDP in 1971 we estimated at 3.8 percent of the GDP. Also, while cost savings are not included in national accounts, the estimated savings over sea transportation costs for goods and passengers were equal to 2.9 percent of GDP. Thus, the true total direct contribution was 6.7 percent of GDP. The number of full-time jobs created was 66,000,

about four percent of the labor force.

The tourist expenditure direct contribution to GDP we forecast to grow from the 1972 level of 5.3 percent to 12 percent in 1985 and to 16 percent in 1995.

If the demand for air services cannot be met because of failure to provide adequate facilities, then there would be an economic penalty on Hong Kong. We investigated this aspect of the problem in some detail. We made two conservative assumptions: namely, (1) one-fourth of all visitor air passengers denied air transport would find another way to reach Hong Kong (mostly by sea), and (2) the present value of future income, expressed as a constant value currency, would be determined by using a 10 percent discount rate.

Based on the conservative assumptions, the present value (in 1975) of loss to the GDP by 1995 if Kai Tak remains the sole airport serving Hong Kong was estimated at US $1.6 billion (1973 dollars). Using somewhat less conservative assumptions, namely, that only five percent of visitors denied air transport would reach Hong Kong, and using a five percent discount rate which would represent a more normal return to capital with constant prices, the present value of the total economic penalty by 1995 would be on the order of US $4.8 billion. These figures are based on the most probable forecast of air services demand. If the low forecast range were used instead, the loss would be considerably less but still very significant. Losses computed for the high

range of demand were astronomical.

Financial forecasting and planning has required the availability of the detailed operating statements and balance sheets of each airport. In the case of Jakarta, they were available for four years and were in reasonably good order. In the case of Hong Kong, they were available for a decade.

Applying the passenger forecast and aircraft operations forecast to develop revenue estimates and operating cost projections, required a good deal of detailed effort by staff members familiar with finance and accounting.

Initial tests of the financial feasibility of alternative approaches to a future air transportation system for Hong Kong were done with constant currency values. When a preferred program was selected, the financial analysis and planning was then done with current values reflecting assumptions about inflation over the planning period. This was necessary to properly anticipate real borrowing requirements.

The prospective sale of part or all of the existing airport land and buildings, after a new airport was opened, was an important element of financial planning in both cases. Present land values and trends in land value for property adjacent to the present airport were available in Jakarta, and estimates were provided by the Steering Committee in Hong Kong. The growth rate of land values for fairly central urban land is at least as rapid as the growth rate in the general price level.

The planned sale of the old airport thus would contribute to early retirement of airport debt.

At both Jakarta and Hong Kong, the loans to cover foreign exchange expenditure would be completely covered before the end of the planning period, and at Hong Kong the local currency capital expenditures - whether borrowed or advanced by the Government - would have been covered by 1995, even with the low traffic forecast.

In the final summing up, it was concluded at Jakarta that:

- A new airport at a new site would be the cheapest way to meet the demand after 1980.
- The best site which is on level land on the outskirts of Jakarta was far superior to the present site in terms of air safety, lack of noise pollution, and capacity for expansion.
- Failure to move to the new site would cause an actual loss of business and tourist passengers, and substantial delay for others over the 1976-1990 period. Converted into financial terms, the 1972 present value of these losses, at a 20 percent discount rate, would be 1.6 to 2.5 times the net present value of construction costs less sale of the present airport (all at constant 1970 prices).
- Because of the rapid rise of urban land values, the opportunity cost of staying at the present airport would impose a steadily increasing economic penalty after 1976.
- The revenues from a new airport would cover debt obligations

for borrowing of foreign currencies for construction purposes an average of twice; the rate of return on government financing for local currency construction costs would be 15 percent; the government would secure a payback of its advances by 1988; and the foreign exchange supply generated by 1990 would be approximately 75 million 1970 dollars.

- That postponing construction two years, but no longer, to await an increase in traffic would give a lower present value cost (as of January 1972), but that a longer postponement would give a gradually rising present value cost because of increasing penalties from overflights, delays, and the escalating opportunity cost of the present airport.

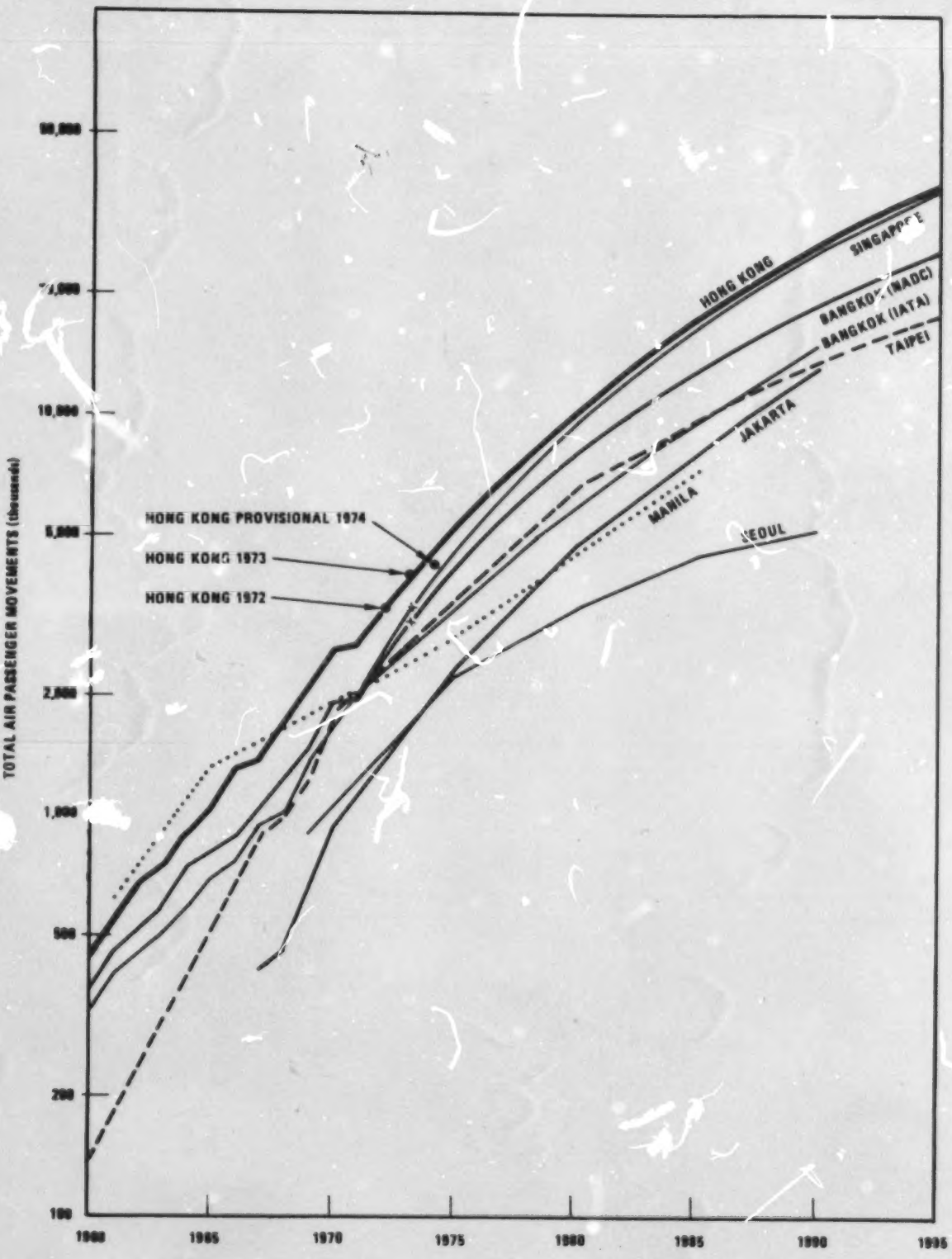
The consultants recommended that the Government of Indonesia make an immediate decision to construct a new airport to handle both international and domestic traffic at the optimum site, and plan construction to open in 1979. Interim arrangements to handle traffic expansion until then could be made by a limited expansion of Kemayoran or by providing international passenger facilities at a military airport on the outskirts of Jakarta and improving its runway.

The Government of Indonesia has followed the second option for the 1970's. In 1974 at the military airport of Halim, it opened international passenger facilities which will be adequate for a few years. After waiting a year to watch the air traffic demand, the Government decided to build a completely new airport at the recommended site. They are acquiring

the site, and are preparing plans for construction.

For Hong Kong, the principal conclusions were:

- That failure to build a new airport would cost the colony in gross product an estimated US $8 billion between 1985 and 1995 in 1973 prices, the present value in 1975 of this amount at a 10 percent discount rate was US $1.3 billion and, with a more liberal estimate of loss and a 5 percent discount rate which would be appropriate for constant prices, the 1975 present value of loss would be over US $4 billion.
- That construction costs of a new airport in constant prices would be US $800 million in 1973 prices.
- That net revenues from a new airport would more than cover all construction costs and interest on loans by 1995, assuming escalation of both construction costs and operating costs and revenues.
- That the ratio of net earnings after depreciation to total value of fixed assets would meet the Government's requirement for adequate return on capital expenditures.
- That the sale of the present airport after a new airport was opened would cover much of the construction cost of a new airport.
- That the noise pollution problem would grow to be so severe that before 1980 there could be strong public pressure to restrict evening and night use of the present airport.



Regional Airports — Experience and Forecasts